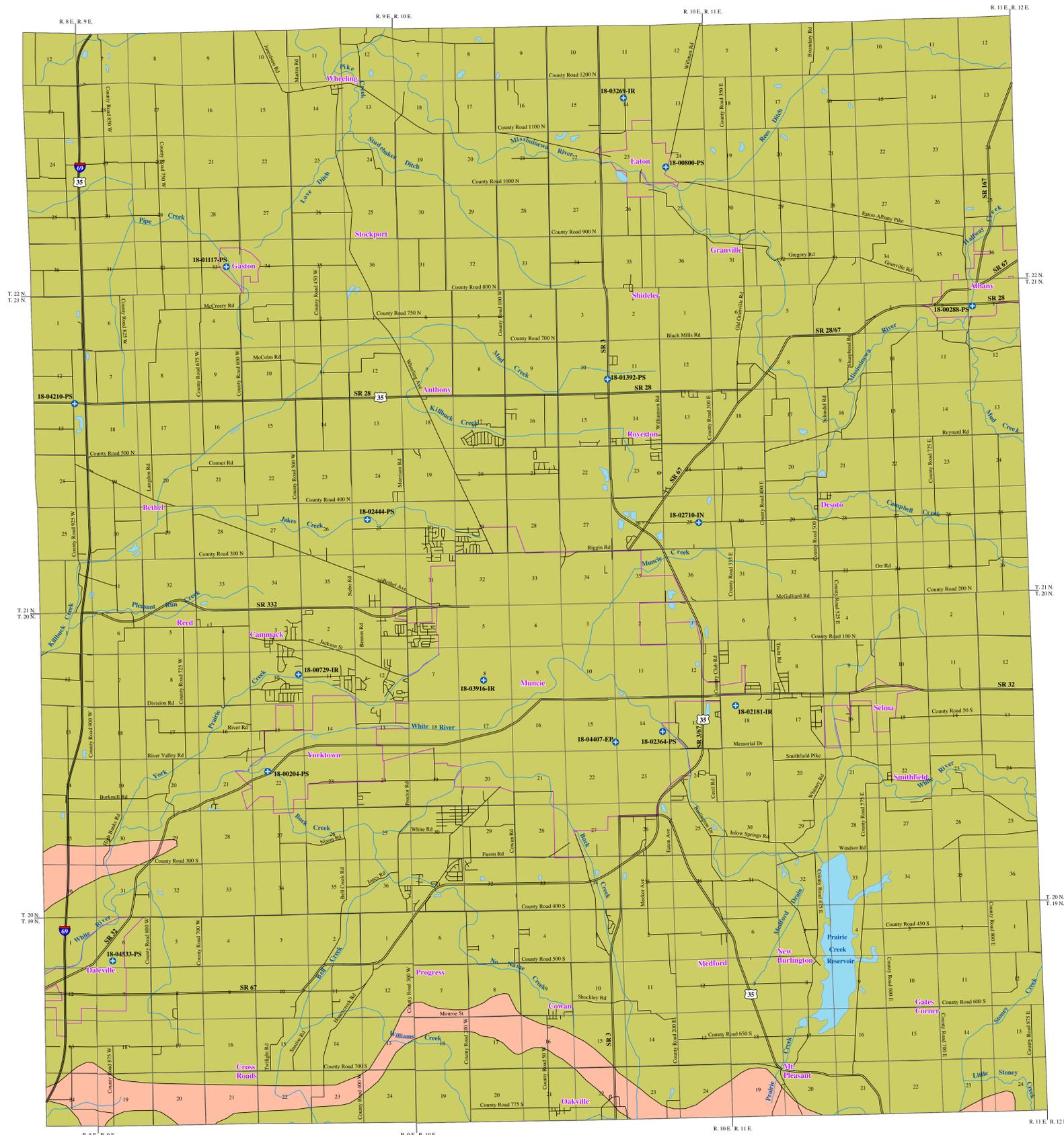


BEDROCK AQUIFER SYSTEMS OF DELAWARE COUNTY, INDIANA



The occurrence of bedrock aquifers depends on the original composition of the rocks and subsequent changes which influence the hydraulic properties. Post-depositional processes, which promote jointing, fracturing, and solution activity of exposed bedrock, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability in many places is greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers.

Unconsolidated deposits of varying thickness overlie bedrock aquifer systems in Delaware County. Most of the bedrock aquifers in the county are under confined conditions. In other words, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing formation.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and glacial till act as aquitards, restricting recharge to underlying bedrock aquifers. However, fracturing and/or jointing may occur in aquitards, which can increase recharge to the underlying aquifers. Hydraulic properties of the bedrock aquifers are highly variable.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Because the bedrock aquifer systems have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

Two bedrock aquifer systems are identified for Delaware County. They are: the Silurian and Devonian Carbonates; and the Maquoketa Group of Ordovician age.

Silurian and Devonian Carbonates Aquifer System **Ordovician - Maquoketa Group Aquifer System**

The Silurian and Devonian Carbonates Aquifer System is extensive throughout nearly all of Delaware County. The system includes Silurian age carbonate rock units (limestone and dolomite) with some interbedded shale units. Total thickness of the Silurian bedrock deposits ranges from 200 to 400 feet. Depth to the bedrock surface ranges from about 0 to 300 feet but is commonly 35 to 110 feet. Total well depths range from 23 to 505 feet but are typically 80 to 180 feet with penetration into bedrock commonly 20 feet or less. Deeper wells in some areas may reach the upper portion of the underlying Maquoketa Group.

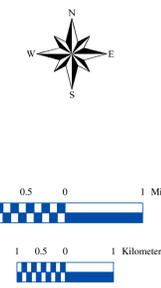
The Silurian and Devonian Carbonates Aquifer System in Delaware County is considered quite dependable of sustaining yields for domestic and some high-capacity users. Many domestic and high-capacity well records, however, note variable thicknesses of sand and/or gravels that directly overlie the bedrock surface. These deposits are present in the central part of the county near the White River and suggests the potential connection of overlying sands and gravels to the bedrock aquifer system. Typical domestic yields range from 10 to 45 gallons per minute (gpm), although some isolated wells are noted at less than 10 gpm. There are 15 registered high-capacity facilities (40 wells) with yields that range from 70 to 800 gpm. Static water levels range from flowing to 80 feet but are commonly 10 to 30 feet.

Most of the Silurian and Devonian Carbonates Aquifer System in Delaware County is overlain by clay of variable thicknesses. Where overlying clay materials are thick, the aquifer system is considered at low risk to contamination. However, solution features (caves) are described in a few well records suggesting minor karst development and there are localized areas, especially near the White River, where the bedrock surface is shallow or exposed. These areas, therefore, are at moderate to high risk to contamination.

The extent of the Maquoketa Group Aquifer System subarea is limited to two buried pre-glacial bedrock valleys located along the south and southwest edges of Delaware County. The system includes mostly shale with some interbedded limestone units. Thickness of the Maquoketa Group in Delaware County ranges from 650 to 750 feet and thins as it dips beneath younger strata to the northwest. The depth to the bedrock surface ranges from 100 to 330 feet.

Few wells have been reported in this system in Delaware County due to the availability of overlying unconsolidated sand and gravel resources and overlying Silurian and Devonian Carbonates. Reported depths of the few wells drilled in the Maquoketa Group range from 140 to 255 feet with the amount of rock penetration typically 20 to 90 feet. Reported well yields range from 2 to 25 gpm with static water levels ranging from 3 to 50 feet.

Thick clay deposits cap this aquifer system; therefore, the Maquoketa Group Aquifer System is not very susceptible to contamination from the land surface.



EXPLANATION

- Registered Significant Ground-Water Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- Lake & River



Map Use and Disclaimer Statement

We request that the following agency be acknowledged in products derived from this map: Indiana Department of Natural Resources, Division of Water.

This map was compiled by staff of the Indiana Department of Natural Resources, Division of Water using data believed to be reasonably accurate. However, a degree of error is inherent in all maps. This product is distributed "as is" without warranties of any kind, either expressed or implied. This map is intended for use only as published.

This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) and County Boundaries of Indiana (polygon shapefile, 20020621), were all from the Indiana Geological Survey and based on a 1:24,000 scale, except the Bedrock Geology of Indiana (polygon shapefile, 20020318), which was at a 1:500,000 scale. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Populated Areas in Indiana 2000 (polygon shapefile, 20021000) was from the U.S. Census Bureau and based on a 1:100,000 scale. Streams27 (line shapefile, 20000420) was from the Center for Advanced Applications in GIS at Purdue University.

Bedrock Aquifer Systems of Delaware County, Indiana

by
Randal D. Maier
Division of Water, Resource Assessment Section

November 2006